PASSIVE HOUSE DESIGN + DETAILING
ADVANCED TECHNICAL ELECTIVE
Department of Architecture | University of Oregon
Spring Term 2018

ARCH 4/510 (4 credits) | CRN: 37684/37685 | P/NP or Graded
Prerequisites: Building Construction & ECS I; enclosures a PLUS!
Time/Location: MW 11:00am–12:50pm | 278 Lawrence Hall
Waiting list preference given to graduating students
Final Exam period: Tuesday, June 12, 10:15 am

Instructor: Alison G. Kwok, PhD, AIA, LEED AP, CPHC
100 Pacific Hall Email: akwok@uoregon.edu
CPHC Teaching Assistant:
Matthew Chua, CPHC

COURSE DESCRIPTION
The Passive House concept is widely considered the most ambitious performance-based energy standard for buildings. Through the implementation of contemporary building science along with comprehensive energy modeling, Passive Houses on average use 90% less energy for space conditioning than code-designed houses. The rigorous performance requirements of the Passive House standard aim to play a vital role in reducing building sector fossil fuel consumption and carbon emissions. Over the past fifteen years, thousands of homes and commercial buildings have been built to the Passive House standard throughout Europe. Recently, the movement has migrated to North America, with over 25 Passive Houses currently certified across the United States and many more in various stages of development.

This course will provide an in-depth understanding of Passive House design, detailing, and construction principles with a specific focus on building envelope and mechanical system design. Emphasis will be placed on advanced building science topics including superinsulation, thermal bridge free detailing, moisture protection, airtight construction, and high performance building components. Aesthetic implications of Passive House design and principles will be discussed. Energy efficiency protocols used in this class are the PHIUS+ 2015 certification standards established by the Passive House Institute US. (www.phius.org). Cutting-edge analysis software including THERM, WUFI-Passive will be introduced. Class time will be split between lectures and hands-on lab activities.

COURSE OBJECTIVES & STUDENT OUTCOMES
• Sustainable Design: to learn about sustainable and regenerative design principles and their application to the built environment through the use of Passive House protocols.
• Building Systems Integration: to understand the unique mechanical requirements of high-energy efficiency construction through the use of Passive House protocols.
• Building Envelope Systems: to understand the enhanced assemblies required to achieve high efficiency performance through analysis of principles such as heat transfer, thermal bridging, & vapor diffusion.

COURSE FORMAT
Class time each week will be split between a lecture and an in-class lab activity. Each Monday, the lecture material for the week will be presented. There will be ample opportunities for class discussion and Q&A. Additionally, guest speakers have been invited to present their experiences with Passive House projects and aspects of the design process. On Wednesday, the majority of class time will be devoted to in-class, hands-on activities which are intended to complement the week’s lecture material. Weekly exercises will be given during the first half of the term. These exercises will be completed outside of class; however, the tools needed to complete the exercises will be discussed during the lab portion of
the class. A final project will be assigned for the second half of the term and will require students to complete the design of a small Passive House based on a given set of parameters.

This course is fast-paced and utilizes the Certified Passive House Consultant (CPHC) training curriculum developed by PHIUS as part of their certification training. The PHIUS schedule has been modified to adapt to university schedules and requirements. Students who successfully complete the training requirements, which includes the online training and in-class training, and successfully pass the online CPHC exam and Final design project, will receive the professional designation of Certified Passive House Consultant (CPHC).

The PHIUS online training component consists of 40+ hours of videos. At the end of each video, there is a short online quiz that must be completed. In the typical PHIUS this online work would be completed prior to a five-day in-class session. As we will be doing these concurrently, I have made attempts to align in-class work with the online portion, but it doesn’t always work. Students are encouraged to work at their own pace on-line with attention to the schedule to benefit the most from the online videos.

All other course materials have been posted on the course Canvas site. You are strongly encouraged to build a course notebook of lectures and exercises. The final CPHC online exam is open book, so a well-organized notebook will of great help.

In addition to course materials (online and in class) a site visit to a local Passive House will likely be planned along with some guest lecturers.

An individual, take-home, final design project of a small residential home that meets the requirements of the PHIUS+ certification will be required. This final design project will be due by May 28th, to permit grading of the exams by the end of the term.

SOFTWARE & HARDWARE REQUIREMENTS
Laptops are required for all class sessions. All software used in this course is free and is windows based. We will use several different software programs during the term. Please download these programs early so that you can assure that they are working in advance of class exercises. Programs and download sites are:

- WUFI Passive 3.0 you will be give download information during the first class; [http://www.ornl.gov/sci/ees/etsd/btric/wufi_software.shtml](http://www.ornl.gov/sci/ees/etsd/btric/wufi_software.shtml)
- Climate Consultant (free download from [http://www.energy-design-tools.aud.ucla.edu/](http://www.energy-design-tools.aud.ucla.edu/))
- Microsoft Excel
- Sketchup (Pro is not needed)
- AutoCAD or ability to read .dwf* files (optional)

GRADING & EXPECTATIONS
This course may be taken as either graded or P/N. In order to receive a “Pass” for the course, undergraduate students must receive a minimum grade of C minus; graduate students must receive a minimum grade of B minus. Grades will be based on class participation, in-class activities, five exercises, and the final project.

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<th>Grade</th>
<th>Percentage</th>
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<tr>
<td>A+</td>
<td>97.5-100%</td>
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<tr>
<td>A</td>
<td>92.5-97.4%</td>
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<td>A-</td>
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<td>B+</td>
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<td>B</td>
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<td>C-</td>
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Homework Exercises: 25%  Online Final Exam: 30%
In-class Activities/Attendance/Participation: 25%  Design Project: 20%
Students are expected to attend class and participate in class discussions. Exercises should be completed in a professional format and should demonstrate care, craft, and an understanding of course material. When completing calculations, all work must be shown and all units must be included throughout the exercise in order to receive full credit. You must accurately cite sources in your work. Exercises are due at the beginning of class on the due date. Late work will be accepted after this point with a late penalty of 5% per day for a maximum of one week or at the discretion of the instructor.

**REQUIRED READING**

Required readings should be completed prior to the course for which they are assigned. Much of class discussion will be based on the required readings; it is therefore critical that you complete the assigned readings for this course. Some readings will be on Canvas under the “Modules” tab or available on reserve from the College of Design Library.

**RECOMMENDED TEXTS**

5. James, Mary. Recreating the American Home, Low Carbon Productions, 2010
14. Waltjien, Tobias, ed. Passivehaus-Bauteilkatalog (German/English), Springer Vienna Architecture, 2009

**ANTICIPATED HOURS for 4-credit class** (140–160 hours, appx 35 to 40 hours per credit)

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<tr>
<th>In-class:</th>
<th>35 hours</th>
<th>Online videos</th>
<th>45 hours</th>
<th>Reading</th>
<th>25 hours</th>
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<tbody>
<tr>
<td>Exercises (5)</td>
<td>15 hours</td>
<td>Take home final</td>
<td>40 hours</td>
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DISABILITIES
The University of Oregon is working to create inclusive learning environments. Please notify me if there are aspects of the instruction or the design of this course that result in disability barriers to your participation. You are also encouraged to contact the Accessible Education in Oregon Hall at uoaec@uoregon.edu. Ideally, I would like to receive a notification letter before the end of the first week of classes so that we can discuss ways to provide accommodations within the classroom and department.

ACADEMIC MISCONDUCT
Plagiarism and/or cheating will not be tolerated. Copying material from the internet is the same as copying it from a book or journal or from another person’s paper. Group discussion of projects is acceptable and encouraged. Collaborative work (which can be very educational) has limits, however. Copying another’s work, or a portion of work, for submission as your own, or allowing others to copy your work, is grounds for a failing grade and the basis for potential referral to the Director of Student Judicial Affairs. All students are expected to know and understand the Oregon Student Conduct Code. Any project submitted for grading is—by the act of submission—certified to be the true work product of the individual who submits the work. This means that the work reflects a personal exercise of judgment regarding accuracy, quality, and completeness.

RECOMMENDED BLOGS & WEBSITES
1. Passive House Institute US (www.phius.org) sign up for newsletter
3. Energy Vanguard (www.energyvanguard.com) sign up for blog
4. Building Science Corporation (www.buildingscience.com)
5. Whole Building Design Group (https://www.wbdg.org)
6. Hammer and Hand (https://www.youtube.com/user/HammerAndHand)
7. The Building Science Podcast (https://positiveenergy.pro/building-science-podcast/)

NAAB CRITERIA
This course addresses the following 2014 NAAB Student Performance Criteria (bold are addressed explicitly). U=understanding, A=ability: Understanding addressed through interactive lectures, readings, quizzes, section activities. Criteria in bold, are tied to specific demonstrations through quizzes, section activities, project homework, and a case study assignment.

Realm B: Building Practices, Technical Skills and Knowledge
B.1 Pre-Design: **B.4 Technical Documentation:** Ability to make technically clear drawings, prepare outline specifications, and construct models illustrating and identifying the assembly of materials, systems, and components appropriate for a building design. **B.6 Environmental Systems:** Ability to demonstrate the principles of environmental systems’ design, how design criteria can vary by geographic region, and the tools used for performance assessment. This demonstration must include active and passive heating and cooling, solar geometry, daylighting, natural ventilation, indoor air quality, solar systems, lighting systems, and acoustics; **B.7 Building Envelope Systems and Assemblies:** Understanding of the basic principles involved in the appropriate selection and application of building envelope systems relative to fundamental performance, aesthetics, moisture transfer, durability, and energy and material resources; **B.8 Building Materials and Assemblies:** Understanding of the basic principles used in the appropriate selection of interior and exterior construction materials, finishes, products, components, and assemblies based on their inherent performance, including environmental impact and reuse.